TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

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BABESIASIS (PIROPLASMOSIS) AND THEILERIASIS.

(1) SERGENT (Edm.), LHÉRITIER (A.) & BOQUET (A.). **Études sur les Piroplasmoses en Algérie. (V^e^ note). Infection par les Piroplasmes de Bovins arrivant de France en Algérie, pendant l'Hiver.** [Algerian Piroplasmoses. (Fifth note). The Infection of Cattle arriving in Algeria from France during the Winter.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 699–700.

This short paper contains a tabular statement of the cases of piroplasmosis which have been observed in imported animals shortly after their arrival in Algeria.

The importation of cattle from Europe into Algeria is practically limited to milch cows. The table gives details of five cases, which were observed during December, 1911, and November, 1912.

The shortest period elapsing between arrival and the onset of the disease was 11 days, and the longest, 57.

The clinical features of the infection varied from case to case, and the parasites present were also variable in morphology; bacilliform, ring-shaped, and pear-shaped parasites being observed.

(2) SPREULL (J.). **East Coast Fever Inoculation in the Transkeian Territories, South Africa.**—*Jl. Comp. Path. & Therapeutics.* 1914. Dec. Vol. 27. No. 4. pp, 299–304.

Whereas in Natal success attended the efforts made to stamp out the disease, the measures that were adopted there were inapplicable in the Transkei. The short-interval dipping system has proved to be of the greatest value by destroying the ticks. In the Transkei, however, although the value of this method was realised by the authorities, it was impossible of adoption. The difficulties in the way of providing sufficient tanks, especially in view of the short time available, and the impossibility of educating the natives to realise the value of the method, compelled the adoption of other measures. The only alternative was to practise whatever method of inoculation promised any degree of success.

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The first outbreak of the disease occurred at the end of March, 1910, and the author made an attempt to carry out protective inoculation in June of that year. The results were not satisfactory, but the author admits that worse have been obtained since.

The following year THEILER's method was adopted and by November a start had been made in inoculating animals in large numbers. Since that time considerably over a quarter of a million cattle have been treated.

The method adopted is the intravenous injection of a mixture of spleen and lymphatic gland obtained from an animal in an advanced stage of the disease. These materials are passed through a mincing machine.

Special precautions are necessary in carrying out the immunisation and these may be summarised as follows :—

(1) The animals must be free from infection at the time of inoculation.
(2) They should be on uninfected pasture, and should be kept there for 14 days after inoculation.
(3) The vaccines must be prepared from materials derived from animals in an advanced stage of infection. Though such vaccines frequently cause loss they are preferable to weak vaccines, as these are apt to confer no immunity at all.
(4) Special care must be exercised to prevent bacterial contamination, and vaccines must be used within six hours of preparation in winter and four hours in summer.
(5) Thick vaccines are likely to cause thrombosis, and peptone is preferable to aleuronat for admixture with the vaccine.
(6) Vaccines derived from several animals should be mixed so as to obtain uniformity.
(7) Vaccinated animals must be placed on heavily infested land on the 15th day, and they must not be dipped.

The results depend upon the hold that the disease has on a herd. In clean herds the successes number about 70 per cent., in slightly infected herds from 50–60 per cent., and in moderately infected herds 30 per cent.

If clean cattle are inoculated when on infected veldt and kept there, the percentage of successes may be only 10 or 15. Where cattle are running on slightly infected veldt, it is recommended that they are dipped every five days for the first fortnight.

A single vaccine may give very varying results in a number of herds inoculated at the same time.

Abortion and lameness from thrombosis have been frequent accidents. Cattle should only be vaccinated at such seasons when highly infected veldt is available for a very thorough tick test afterwards.

The tick test should last for six to eight weeks according to the degree of infestation of the veldt. In winter a period of three months even does not yield such reliable results.

A second vaccination is considered advisable when a proper tick test has not been possible.

The conditions of the method indicate that it is one that cannot be practised in a civilised area except to cut short mortality rapidly in a badly infected district, and incidentally reduce the number of animals to such an extent that short-interval dipping could be adopted.

BRITISH MUSEUM

Cattle that have been inoculated and have passed through a satisfactory tick test, have maintained their immunity for three years and more.

Since the invasion of the Transkei by the disease, about 900,000 cattle have been lost, and the author believes that it will not be eradicated for some years to come, even under the most favourable circumstances.

(3) i. CHALMERS (Albert J.) & ARCHIBALD (R. G.). **Babesia or Piroplasma.**—*Jl. Trop. Med. & Hyg.* 1914. Nov. 2. Vol. 17. No. 21. p. 323.

ii. LEIPER (R. T.). **Babesia or Piroplasma: A Reply to Chalmers and Archibald.**—*Ibid.* 1915. Jan. 1. Vol. 18, No. 1. p. 7.

The following are verbatim copies of the above communications :—

" i. While searching through botanical literature in the course of a certain joint work in connection with the *Fungi imperfecti* we chanced upon the following :—

" *Schizomycetaceae* Naegeli 1857.

" Genus *Babesia* Trevisan 1889.

" *Definition.*—Cocci ellipsoidei, longitudinaliter binatim seriati (diplococci longitudinales) in filamenta moniliformia, pseudodichotoma nuda concatenati. Arthrosporae macrosomae in apice filamentorum obvenientes.

" *Etymology.*—Derived from the name of the celebrated Roumanian bacteriologist V. Babès.

" *Species.*—(1) *B. xanthopyretica* Trevisan 1889, found in people suffering from yellow fever; (2) *B. erysipeloidis* Trevisan 1889, found in people suffering from erysipelas.

" It is obvious that as Trevisan applied the name *Babesia* in 1889 to a genus containing certain bacteria, this name cannot be used a few years later to name a genus of the protozoa and, therefore, the name *Babesia* Starcovici 1893 cannot be retained.

" This brings the nomenclature of the genus of protozoal organisms discovered by Babès down to the year 1895, when Patton introduced the word ' Piroplasma.'

" The synonyms will therefore stand as follows :—

" Genus *Piroplasma* Patton 1895.

" *Synonyms.*—Haematococcus Babès 1888 (*nec* Agardh); *Pyrosoma* Smith and Kilbourne 1893 (*nec* Péron); *Babesia* Starcovici 1893 (*nec* Trevisan); *Amoebosporidium* Bonome 1895; *Ixodioplasma* Schmidt 1904.

" This, we hope, will end the confusion in that some authors use the name ' Babesia ' and others ' Piroplasma ' for the same genus of protozoal organism."

" ii. In a recent issue of the *Journal of Tropical Medicine and Hygiene* attention is called by Chalmers and Archibald to the occurrence of the term Babesia in botanical literature and the statement is made : ' It is obvious that, as Trevisan applied the name Babesia in 1889 to a genus containing certain bacteria, this name cannot be used a few years later to name a genus of the protozoa, and, therefore, the name *Babesia starcovici*, 1893, cannot be retained.'

" It appears to have escaped the authors' recollection that the first of the International Rules of Zoological Nomenclature stipulates that : (1) Zoological Nomenclature is independent of Botanical."

(4) HINDLE (E.) & GÓZONY (L.). **Abderhalden's Reaction and its Application in certain Protozoal Infections.**—*Parasitology.* 1914. Oct. Vol. 7. No. 3. pp. 228–239.

The introductory portion of this paper, which covers some four pages, outlines the nature of the reaction and explains its use, taking

as an example the diagnosis of pregnancy. Then follows a detailed account of the technique employed, special attention being directed to the controls that are essential.

In view of the fact that Gózony has obtained some very favourable results with the method in connection with spirochaetosis, trypanosomiasis and sarcosporidiosis, the authors have made some observations with intra-corpuscular parasites—namely, *Theileria parva* and *Babesia canis*.

Theileria parva.—Exp. 1.—A calf was infected by having placed upon it infected nymphs of *R. appendiculatus*. Parasites appeared in the blood on the 17th day. On the 20th day, when 13 per cent. of the corpuscles were invaded, a quantity of serum was obtained from the animal and tested against organs of a normal calf. As a control, a parallel set of tests were made with normal calf serum.

The following table gives the results obtained :—

Organ employed.	+ 1·5 cc. infected serum.	+ 1·5 cc. normal serum.
Brain	+	—
Kidney	—	—
Liver	+	—
Lymphatic gland	+	—
Lung	+	—
Pancreas	+	—
Spleen	+	—
Suprarenal gland	+	—
Thyroid „	+	—
Thymus „	+	—
Control (serum alone)	—	—
Control „	—	—

The calf was killed when moribund on the 26th day. At the time of death about 40 per cent. of the corpuscles contained parasites, and at the post-mortem "all the organs were found to contain infarcts with *Theileria* present."

Pieces of the organs were prepared in the usual manner and were tested against the calf's own serum both active and inactivated.

The results were as follows :—

Organ employed.	+ 1·5 cc. infected serum.	+ inactive infected serum.
Infected Brain	+	—
„ Diaphragm	+	—
„ Heart muscle	+	—
„ Lymphatic gland ..	+	—
„ Lung	—	—
„ Muscle	+	—
„ Pancreas	+	—
„ Spleen	+	—
„ Suprarenal gland ..	+	—
„ Thymus „ ..	+	—
„ Thyroid „ ..	+	—
Control (serum alone)	—	—
„ „	—	—

An experiment was also made with the parasites themselves. The red corpuscles from a litre of the animal's blood were cytolised by digitoxin, the parasites being separated by centrifugation. These

were then washed and mixed with egg albumin, which was then boiled. The resulting coagulum was tested and a strongly positive reaction was obtained. Agglutination and complement fixation tests with the parasites gave negative results.

In a second experiment carried out on the same lines three sets of tests were made. The first when the temperature rose, the second six days later—i.e., the day after parasites appeared in the circulation—and eight days later, when 30 per cent. of the corpuscles were invaded.

In each of these sets of tests active and inactivated serum was used against some of the tissues. The results were as follows:—All the tests carried out with inactivated serum were negative, as were those with active serum taken on the rise of temperature. Three out of 14—viz., tests against lymphatic gland, suprarenal gland, and isolated parasites—were positive with serum taken the day after the appearance of parasites, and nine out of 12 were positive with the third sample of serum.

In the case of *Babesia canis* less satisfactory results were obtained owing to the destruction of the red corpuscles with the resulting liberation of haemoglobin. Satisfactory results were only obtainable with blood taken during the early stages.

In the first experiment one positive result out of six tests was obtained with the serum and liver of a dog inoculated 10 days previously and destroyed three days after the appearance of parasites in the blood.

In a second experiment positive results were obtained with liver, brain, pancreas, heart, and lung, but in this case the serum used contained some haemoglobin.

TRYPANOSOMIASIS.

(5) **Bruce** (D.), **Hamerton** (A. E.), **Watson** (D. P.), & Lady **Bruce**. **Trypanosome Diseases of Domestic Animals in Nyasaland. *Trypanosoma caprae* (Kleine). Part III. Development in *Glossina morsitans*.**—*Proc. Roy. Soc.* 1914. Aug. 27. Series B. Vol. 88. No. B 601. pp. 92–96. With one coloured plate.

An abstract of the previous paper regarding the morphology and pathogenicity of this trypanosome is given in this *Bulletin*, Vol. 1, page 206.

T. caprae belongs to the *T. vivax* group, which comprises trypanosomes the development of which is restricted to the proboscis of the transmitting fly.

Six experiments were carried out with laboratory-bred flies. In three instances the experiments were made at the ordinary laboratory temperature during the winter, and in the others at incubator temperature of 84° F. Of the first group two experiments were successful and the third failed, and of 34 flies used in the positive experiments only two were found to be infected. It is said that the low percentage of infected flies was no doubt explained by the

temperature, and also by the fact that sheep and goats infected with *T. caprae* are unsatisfactory for the feeding of flies, as trypanosomes are variable in their appearance in the blood and are never numerous.

In the experiments carried out at incubator temperature the percentage of infected flies found ranged from 30 to 40.

No attempt was made to study the flagellate in the fly in the early stages as sufficient flies were not available, but a number of illustrations in colour are given of the parasites as found from the 19th to the 30th day, and also of the final stage of development.

Conclusions :—

"1. *Trypanosoma caprae* is capable of passing through a cycle of development in *G. morsitans*, the flies becoming infective some 19 days after feeding on an infected animal.

"2. *Trypanosoma caprae* belongs to the same group as *T. vivax* and *T. uniforme*, the development taking place only in the proboscis.

"3. The final stage of the development takes place in the hypopharynx where the trypanosomes revert to the original "blood form" and become infective."

(6) **Bruce (D.), Hamerton (A. E.), Watson (D. P.), & Lady Bruce. The Trypanosome causing Disease in Man in Nyasaland. The Naturally Infected Dog Strain. Part I.—Morphology.**—*Proc. Roy. Soc.* 1914. August 27. Series B. Vol. 88. No. B 601. pp. 111–130. With 3 plates and 8 charts.

The authors state that this strain differs in so marked a way from the human, fly, and game strains, that had it been found in wild game or in *G. morsitans* it would have been legitimate to make a new species of it. As, however, it was only met with in the chronically diseased dogs, the making of a new species would not be justified. The dogs were obtained in the proclaimed area, but not all infected dogs from the area showed this strain.

Attention is drawn to the fact that this strain is of very low pathogenic power for the monkey and guinea-pig, and also to the small proportion of blunt-ended posterior-nuclear forms.

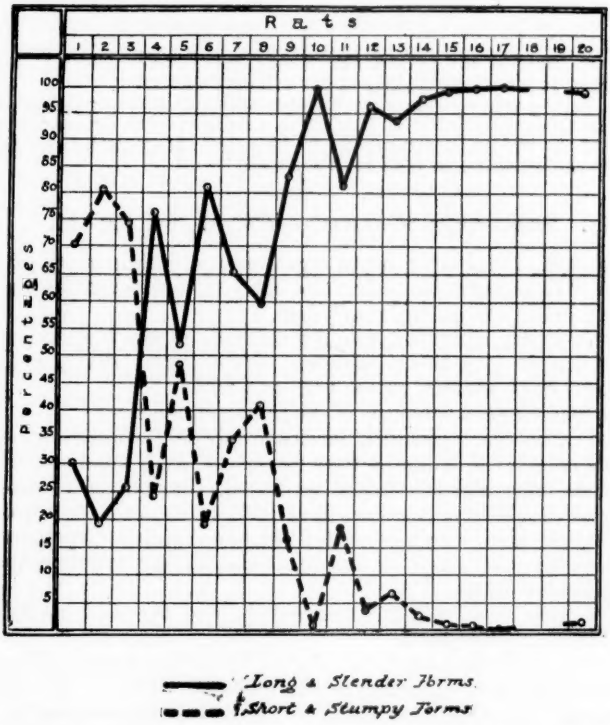
Large numbers of measurements were made of the parasite immediately after it was obtained, at an interval of seven months, and also of two years, it having been maintained in rats during these periods. In the biometric curve constructed on the first set of measurements, it was seen that while the curve indicated dimorphism there was a marked preponderance of short forms. The curve constructed on measurements after passage through eight rats (seven months) was still dimorphic, but the two peaks were almost at the same level. The curve based on the measurements taken after two years in rats was almost of the monomorphic type, the stumpy forms had almost disappeared, and the percentage of long parasites had very greatly increased.

That this was not in the nature of an accident is shown by a chart representing the gradual change of type through an unbroken series of 20 rats. In this chart, which is reproduced*, the unbroken line represents the long slender forms, and the broken line the short stumpy forms.

* From the *Proceedings of the Royal Society.*

The second of these naturally infected dog strains was found to be very markedly dimorphic, the form of the chart almost suggesting that two trypanosomes might be present.

The third strain was practically monomorphic, the majority of the parasites ranging from 26 to 32 microns in length.



"This seems to shew how fallacious it is to reason from laboratory types of trypanosomes to the wild types, and probably accounts for the showers of new species which are constantly falling about our ears."

In view of the possibility of there being in reality two parasites present in these infections, the third strain representing a survival of the slender parasite, an attempt was made to cause Strain 1 to revert to the original dimorphic form.

When this strain, after two years in the rat, was again inoculated into a dog, a reversion to the dimorphic form was produced. In the blood of the rat after two years' passage through rats the peak of the chart of 500 trypanosomes occurred at 29 microns, but when this strain was again passed into a dog the peak of the chart occurred at 21 microns, there being also a small rounded elevation in the curve at 25 to 28 microns. Nearly one-fifth of the parasites were now of the short stumpy type.

From these facts it would appear that passage through the rats favours the production of the long slender parasites, while passage through the dog at once causes a return to the dimorphic type.

No explanation of the origin of these strains in the dog was forthcoming, and an attempt to test the theory that long sojourn in the blood of a dog was responsible for the changes did not furnish any evidence of this being the case.

Conclusions :—

"1. The Naturally Infected Dog strain differs slightly from the other strains of the trypanosome causing disease in man in Nyasaland, in that there are fewer of the posterior-nucleated, blunt-ended forms which are sometimes so much in evidence in the ordinary strains.

"2. Taking into consideration the fact that this strain was only found in three chronically infected dogs, it is concluded that it is an aberrant strain of the widely spread species *T. brucei vel rhodesiense*, the trypanosome causing disease in man in Nyasaland."

Part II. Susceptibility of Animals.—*Ibidem.* pp. 130–138.

The bulk of the experiments regarding the pathogenicity of these strains of trypanosomes were carried out with that called No. 1 strain, as the other two were accidentally lost.

In a tabular statement are given details of the inoculation of a large number of animals including cattle, goats, sheep, antelope, monkeys, dogs, rabbits, guinea-pigs, and rats.

The following is a summary of the results obtained :—

Four cattle were inoculated, but in one only did the infection succeed. In this animal the parasites were present in small numbers on three occasions only, and the animal recovered. Six out of 21 goats inoculated shewed trypanosomes in their blood on a few occasions and in small numbers. Four recovered and one died, but no post-mortem examination was made to ascertain whether the infection was responsible for death.

Two sheep were inoculated successfully, and one died, probably of the disease, after 64 days.

Six out of 27 monkeys were infected, but all recovered. The strain became virulent for dogs after several passages.

In four the inoculation failed to infect, and five recovered. The remainder died in from 11 to 102 days. The lesions were those of nagana.

Two rabbits were successfully inoculated, and both shewed the lesions of nagana in a rather mild form.

Two guinea-pigs out of 21 became infected, but recovered.

The strain was invariably fatal for the rat, death taking place in from 7 to 94 days (average 30·8).

The authors consider that for the present the parasite should be included among the strains of *T. brucei* vel *rhodesiense*, but that if it should be decided to make it a separate species the name *T. anceps* would be a suitable one. Conclusions :—

"1. The Naturally Infected Dog strain is fatal to dogs, rabbits, and white rats, but oxen, goats, monkeys, and guinea-pigs appear to be refractory.

"2. The Commission is of opinion that this is an aberrant or exceptional variety or strain of the trypanosome causing disease in man in Nyasaland—*T. brucei* vel *rhodesiense*."

Part III. **Development in** *Glossina morsitans.*—*Ibidem.* Sept. 15. No. B 602. pp. 213–218.

Eleven experiments were carried out and of these two gave positive results. In the first of them, flies were fed on an infected rat for five days, and then in succession on a dog, monkey, guinea-pig, duiker, and a second monkey. The period during which the flies were fed upon these animals ranged from 3 to 25 days, and they were starved for one day between successive feeds. Of this group only the guinea-pig failed to become infected.

In the second successful experiment the flies were fed upon an infected rat for six days and then after one day's starvation upon a healthy dog for 58 days. The number of days elapsing before the flies became infective were 24 and 58 days respectively. In both cases the flies were kept at 84° F, and all were laboratory bred.

Thirty flies were used in the first of the successful experiments, and when these were dissected three were found to be infected.

In one of these trypanosomes were found in the proventriculus, and in all three the fore- and mid-guts were invaded. In one the hind-gut shewed trypanosomes, and in one there were trypanosomes in the salivary glands.

It appears to be probable that the one fly having an infection of the salivary glands was responsible for all the infections.

In the negative experiments 185 flies were dissected and 11 were found to be infected. None of these, however, had any trypanosomes in either the proboscis or the salivary glands. With regard to the morphology of the trypanosomes in the flies, those present in the intestine were exactly like those of the human strain in the same situation, and the salivary glands of the single fly showing invasion of these organs contained exceedingly numerous small active trypanosomes which when stained were seen to be typical blood forms. Conclusion:

"The trypanosome of the Naturally Infected Dog strain belongs to the same group as *T. gambiense* and *T. brucei* vel *rhodesiense*, the trypanosome causing disease in man in Nyasaland, and is probably merely a weak strain of the latter species."

Part IV. **Experiments on Immunity.**—*Ibidem.* pp. 219–226.

This paper contains in tabular form the details of a number of experiments carried out with the object of ascertaining whether the "Naturally infected dog strain" would protect against the "Human," "Wild Game," "Wild *Glossina morsitans*," and "Zululand 1913" strains.

Complete cross tests were not possible as it is only exceptionally that an animal recovers from the human or other strains. The results of the experiments are set out in the conclusions.

Conclusions:—

"1. The Naturally Infected Dog strain does not protect animals from the Human, Wild *G. morsitans*, and Zululand, 1913, strains.

"2. The Wild *G. morsitans* strain and the Naturally Infected Dog strain do not protect animals from the Human or the Zululand, 1913, strain.

"3. The Wild *G. morsitans* strain does not protect against the Human strain.

"4. In spite of the damaging evidence of these experiments, the Commission still holds the opinion that the Naturally Infected Dog strain is a weak strain of the trypanosome causing disease in man in Nyasaland, *T. brucei* vel *rhodesiense*."

(7) Gallagher (G. H.). **The Transmission of *Trypanosoma brucei* of Nigeria by *Glossina tachinoides*, with Some Notes on *Trypanosoma nigeriense*.—*Jl. Trop. Med. & Hyg.* 1914. Dec. 15. Vol. 17. No. 24. pp. 372–375.**

The author records the occurrence of *G. tachinoides*, *G. palpalis*, and *G. caligenea* in the Eket district where he was in charge of the sleeping sickness camp.

T. brucei.—The trypanosome to which the author refers under this name is a polymorphic parasite shewing posterior nuclear forms. The strain was obtained by feeding 128 *G. tachinoides* upon a guinea-pig.

In the living state the parasite is freely motile, but not much change of position is observed. In stained preparations it is seen to possess the classical polymorphic morphology.

In inoculated animals the long forms predominated at first and then the stumpy and intermediate forms increased, and in cases where the infection was relatively chronic these become dominant.

There was no definite relationship regarding the number of posterior nuclear forms present.

The parasite varied from 12 to 32 microns in length.

In rats, in which the strain was kept after having been passed through two guinea-pigs, the average length of life was 35 days, with a minimum of 14 and a maximum of 59. The period of incubation ranged from 6 to 13 days.

T. nigeriense.—This was obtained by the inoculation of a guinea-pig and a monkey with cerebro-spinal liquid from a case of sleeping sickness which terminated fatally a few hours later.

Parasites were never numerous in the blood of these animals.

Three guinea-pigs and a mouse inoculated respectively from the original guinea-pig and monkey had not shewn evidence of infection at the time of writing.

The short stumpy forms described by Macfie, upon which the claim for specific identity are based, have been found in the original animals which were still surviving at the time of writing, and according to competent observers they were relatively more abundant than in any strains of *T. gambiense*. A claim is therefore made for the retention of the name *T. nigeriense*.

(8) Bruce (D.), Hamerton (A. E.), Watson (D. P.), & Lady Bruce. **Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland: The Human Strain (continued).—VI to X.—*Proc. Roy. Soc.* Sept. 15. 1914. Series B. Vol. 88. No. B 602. pp. 190–205.**

The authors have already published an account of the morphology of five strains of human trypanosomes (see this *Bulletin*, Vol. 1, p. 205), and in the present communication a further set of five is dealt with.

In three instances the trypanosomes were inoculated direct from the infected natives into rats, and in the remaining two instances the strains were passed through a single monkey before the rat was inoculated. The measurements were made in each case from preparations of the rat's blood.

Tables are given showing the maximum, average and minimum length of 500 trypanosomes of each strain, the distribution in respect

of length, the percentage of posterior-nuclear forms, and the average, the maximum, and the minimum breadth of the trypanosomes. A curve based upon the measurements obtained is also given in each case.

From the figures given the following details may be gathered: The average length of the five strains of trypanosomes ranged from 21·2 to 23·5 microns, the maximum length from 32 to 34, and the minimum length from 14 to 17 microns.

The figures showing the percentages of posterior nuclear forms indicate a considerable variation in this respect, ranging from 5·0 to 28·6.

With regard to the breadth of the trypanosomes belonging to the different strains there was very little variation, the average ranging from 2·56 to 2·71, the maximum from 4·5 to 5·0, and the minimum being in every case 1·25 microns.

Six experiments were made to show by means of inoculation with a single trypanosome that a single species was being dealt with. In three instances a positive result was obtained, a rat inoculated with a single long slender trypanosome developing in its blood all the forms found under natural conditions.

The following conclusion is drawn :—

"These five further strains of this trypanosome, isolated from five natives in Nyasaland, belong to the same species, *Trypanosoma brucei* vel *rhodesiense*, the trypanosome causing disease in man in Nyasaland."

(9) Bruce (D.), Hamerton (A. E.), Watson (D. P.), & Lady Bruce. **The Trypanosome causing Disease in Man in Nyasaland: The Liwonde Strain. Part I—Morphology. Part II.—Susceptibility of Animals.**—*Proc. Roy. Soc.* 1914. August 27. Series B. Vol. 88. No. B 601. pp. 97–111, with 5 charts.

The strain described in this paper was obtained in the Upper Shire Valley about 100 miles south of the "Proclaimed Area," at a place where no cases of disease in man had been observed up to that time. Subsequently a case was discovered at Mpimbi, about 50 miles further south. The strain was taken to Kasu in dogs, and subsequently passed into rats and other animals, but for the purposes of studying the morphology of the parasite only trypanosomes from rats were used.

The parasites were measured in the manner adopted by Bruce, and charts based upon the measurements and distribution of the parasites according to their size were constructed. Tabulated statements also show the effects of the three strains when injected into animals of different species.

The following conclusions are drawn :—

"1. The three wild *G. morsitans* strains from the Liwonde district resemble each other closely, and all belong to the same species of trypanosome.

"2. The Liwonde strain belongs to the same species as that occurring in man, wild game, and wild *G. morsitans* inhabiting the 'Proclaimed Area,' Nyasaland—*T. brucei* vel *rhodesiense*.

"3. Hence it would appear that wild *G. morsitans* occurring in a district 100 miles south of the 'Proclaimed Area' are infected with the trypanosome which causes the human trypanosome disease of Nyasaland."

(10) Bruce (D.), Hamerton (A. E.), Watson (D. P.), & Lady Bruce. **The Trypanosome causing Disease in Man in Nyasaland. II. The Wild-game Strain. III. The Wild *Glossina morsitans* Strain. Part II. —Susceptibility of Animals.**—*Proc. Roy. Soc.* Sept. 15. 1914. Series B. Vol. 88. No. B 602. pp. 205–212.

The previous papers dealing with the morphology of these two strains are abstracted in this *Bulletin*, Vol. 1, pp. 270 and 271.

In the present communication the effects of the strains upon animals are set out in tabular form and comparisons are instituted between them and also between them and the human strain.

The results obtained are collected into the following table :—

The average duration in days of the wild-game, wild *Glossina morsitans*, and human strain of the trypanosome causing disease in man in Nyasaland, in regard to their virulence towards various animals.—

Strain.	Ox.	Goat.	Monkey	Dog.	Rabbit.	Guinea-pig.	White rat.
Human	134	42	26	34	28	67	30
Wild game ..	—	46	38	41	—	—	32
Wild *G. morsitans*	Rec.	54	38	29	47	81	26

A further table compares the percentages of recoveries in the different species inoculated with the three strains, In the case of the human strain 80 per cent. of the cattle inoculated recovered, but there were no recoveries among the other species of animals inoculated. There were no recoveries from inoculations with the wild-game strain. With the wild *G. morsitans* strain, all the cattle, six per cent. of the goats, seven per cent. of the monkeys, and four per cent. of the dogs, recovered.

The conclusions are as follows :—

"1. The pathogenic action on various animals of the Human strain, the Wild-game strain, and the Wild *G. morsitans* strain is so much alike, that it may be concluded that they all three belong to the same species of trypanosome.

"2. This species in *T. brucei* vel *rhodesiense*, the trypanosome causing disease in man in Nyasaland."

(11) Macfie (J. W. Scott) & Gallagher (G. H.). **Sleeping Sickness in the Eket District of Nigeria.**—*Ann. Trop. Med. & Parasit.* 1914. Dec. 15. Vol. 8. No. 3. pp. 379–438. With 5 plates, one text-figure, one map, and two appendices.

The existence of the disease was first suspected in 1906, and the first case diagnosed by the discovery of the trypanosomes was in 1912.

Clinically the disease is much milder than that occurring in the Congo and Uganda. A brief description of the physical and meteorological conditions of the district is given and it is mentioned that sheep, goats, and dogs are commonly met with, and that a few dwarf cattle are also found. Larger cattle and horses are unknown. The density

of the population (about 250 per square mile) explains the almost complete absence of game. Small antelope and occasionally elephants may be found, and in some places monkeys are common.

Biting flies are fairly numerous. Tabanidae are abundant on the Qua Iboe River and *Chrysops dimidiata* has been found in a number of places. Tsetse flies have a wide distribution but occur in small numbers only.

The centre of the sleeping sickness area is at Ikotobo, and the commonest species of tsetse fly there is *G. tachinoides*. It is pointed out that this species is especially easy to get where there are pigs. The pig, however, is considered an unclean animal, possibly on account of the association with flies, and is forbidden by the native law, but the law is evaded.

Diagnosis was difficult because clinically the disease was very mild, and because trypanosomes were very difficult to detect.

Microscopic examination of thin and thick blood smears, and of smears of gland juice obtained either by puncture or by incision was resorted to. Experimental inoculation was practically impossible as experimental animals were difficult to obtain (monkeys were unobtainable), and also the trypanosome has a low degree of virulence and sometimes fails to infect guinea-pigs.

In no case were trypanosomes found in the peripheral blood, and in a large number of cases examination of gland juice also proved negative.

The symptoms of the disease are summarised.

In view of the difficulty of discovering the trypanosome and of the fact that spontaneous recovery appears to occur, it is difficult to gauge the value of treatment, but a weekly intramuscular injection of 6 grs. of atoxyl appears to be well tolerated. The presence of intercurrent diseases such as malaria also complicates matters.

The trypanosome is of very low virulence for experimental animals. The white rat appears to be refractory and only a proportion of guinea-pigs inoculated with materials containing trypanosomes become infected (one out of seven). Five cubic centimetres of blood from a proved case of the disease failed to infect a guinea-pig. In the single positive guinea-pig, trypanosomes were first seen on the 27th day, and they remained very scanty for about a week, but they then increased slightly in numbers although they were still rare. The presence of short thick parasites which the authors believe to be characteristic of the strain was detected.

In view of the scantiness of trypanosomes in the enlarged glands and their absence from the peripheral blood, a difficulty arises to explain the infection of the fly. It is suggested that the human infection must depend upon a cycle of development including an insect and another animal host which has not yet been identified, the trypanosome losing virulence in the human host. In this connection attention is drawn to BRUCE'S observation that *T. simiae* lost its virulence for the monkey after passage through the goat.

G. tachinoides was found to harbour *T. pecaudi* (*T. brucei* Uganda), *T. vivax*, and *T. pecorum*, and possibly also *T. nigeriense*, but the insusceptibility of experimental animals to this trypanosome prevented any actual evidence of this being obtained.

The authors were unable to obtain any wild animals for examination as game is very scanty, but in sixteen domestic animals, viz., four sheep, four goats, two dwarf cattle, four dogs, and two pigs *T. nigeriense* was not found. The dwarf cattle were found to harbour a parasite resembling *Theileria parva*, but no symptoms of illness were observed.

Appendix I by Eakin (W. C. W.) contains a summary of the views held by the natives regarding the disease.

In the second appendix, by Macfie, are given the details of six experiments in which wild *G. tachinoides* were fed upon healthy animals with the object of discovering what species of trypanosomes may be transmitted by this fly. The results showed that *T. pecaudi* (*T. ugandae*), *T. pecorum* (*T. congolense*), and *T. vivax* are transmitted by *G. tachinoides*.

(12) Ogawa. **Étude Morphologique et Biologique sur *Trypanosoma pecaudi*.** [Morphological and Biological Studies of *Trypanosoma pecaudi*.]—*Ann. Inst. Past.* 1914. July. Vol. 28. No. 7. pp. 677–691. With 7 curves and 1 text-fig.

The strain used in these investigations was one brought from Dahomey in 1908 and since maintained in guinea-pigs.

In guinea-pigs the course of the disease varied from eight to 20 days, with an average of 16. The period of incubation was two to six days. In the mouse the disease runs a more rapid course, death occurring on an average on the sixth day.

In guinea-pigs a crisis occurred which lasted from one to three days, during which period trypanosomes were not discoverable in the blood. No crises occurred in the mice.

Long slender forms and short stumpy ones were observed in all the experimental animals.

In the fresh state the parasite is very actively motile, the motility often involving considerable translation. In stained films posterior nuclear forms have been observed, and in one instance the nucleus was posterior to the blepharoplast.

The long slender parasites first appeared in the blood, and were followed by the short stumpy forms. The latter steadily increased in number for a time, and then the long forms again appeared to predominate just before death.

Numerous tables and charts are given showing the measurements of the trypanosomes and their proportional distribution, and attention is drawn to the great variability of form of curves obtained.

Serum obtained from infected guinea-pigs during crises was found to have a protective action, in that it prolonged the period of incubation when mixed with infective blood and allowed to remain in contact with it for a variable length of time before the mixture was injected into a test animal.

Attempts to cultivate the trypanosome failed, although they retained their vitality in some cases for several days in the culture media. These persistent trypanosomes were, however, found to be avirulent.

(13) LAVERAN (A.) & ROUDSKY (D.). **De l'Inoculabilité du *Trypanosoma lewisi* au Loir (*Myoxus glis*).** [The Inoculability of *T. lewisi* for the Dormouse *Myoxus glis*.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 654–657.

In a previous communication (see this *Bulletin*, Vol. 2, p. 131) the authors published their observations regarding the infection of a number of species with *T. lewisi* and *T. duttoni*, and they drew special attention to the facts that the infections produced were always of short duration and that they could not be transmitted in series of any species.

The authors have had the opportunity of carrying out a series of similar experiments with a number of loirs* received from Italy. They are only very rarely found in France.

In the course of their experiments they found that the loir is refractory to *T. duttoni*, but susceptible to *T. lewisi*. They further found that *T. lewisi* could be transmitted in series in the loir. The course of the infections did not exceed four or five days, but trypanosomes were sometimes present in the blood in considerable numbers.

Recovery from the infection left the animals with a degree of immunity which enabled them to resist re-infection for a period of six weeks. Lack of animals prevented further experiments.

Attention is drawn to the fact that the lerot, which is closely allied to the loir, is far less susceptible to *T. lewisi*, and, as already stated, the loir was found to be resistant to *T. duttoni*, which is so closely allied to *T. lewisi*.

(14) LAVERAN (A.). **L'Immunité que confère souvent aux Caprins une Première Atteinte de Trypanosomiase peut-elle être transmise héréditairement?** [The Possible Hereditary Transmission of the Immunity sometimes conferred upon Goats by an Attack of Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 724–730.

The experiments detailed in this paper were carried out with the object of ascertaining whether, in countries where trypanosomiasis occurs, an advantage would attach to the use of animals that had acquired immunity.

During the last two years a number of observations have been made on the kids of goats which the author has used in some of his experiments regarding trypanosomiasis. Full details of these six experiments are given in the paper, and are summarised as follows:—

(1) A goat which had recovered from a severe infection with surra, and which was immune against the disease, gave birth to a kid which died shortly after birth. Blood collected from the heart of the kid immediately after death yielded a serum which was quite inactive when mixed with the virus of surra.

(2) A goat which had acquired immunity against surra gave birth to a kid which was inoculated with *T. evansi* 26 days later. The kid

* The loir is the large European dormouse (*Myoxus glis*); the lerot is smaller and belongs to Southern Europe and Northern Africa (*Eliomys*; several species).

became infected. At an interval of 71 days after inoculation, the animal died with suppurative arthritis, which did not appear to have any connection with the trypanosomiasis.

(3) A goat which was immune to surra and debab gave birth to two kids. One of these was inoculated a month after birth with the virus of debab. It became infected, and the disease ran a normal course. The other, which was inoculated with the virus of surra six weeks after birth, also became infected, the disease following a normal course.

(4) A goat which had recovered from infection with *T. gambiense* gave birth to two kids. One of these was bled a month after birth and the serum obtained when mixed with *T. gambiense* was found to be inactive. This kid became infected on two occasions when inoculated with *T. gambiense.*

(5) A goat which had acquired an immunity to *T. congolense* gave birth to a kid which became infected when inoculated with this trypanosome 16 days after birth. The disease took a chronic course and terminated fatally.

(6) A goat which had acquired an immunity to *T. congolense* gave birth to three kids. One of these was inoculated 43 days after birth with *T. congolense.* Infection resulted and the disease took a normal course.

The conclusion to be drawn is that animals which have acquired immunity are not specially suitable to breed from, in infected countries.

(15) Ciuca (M.). **Sur l'Action Protectrice et Immunisante du Sérum des Animaux Trypanosomés traités à l'Emétique de Potassium.** [The Protective and Immunising Properties of the Serum of Animals infected with Trypanosomes after Treatment with Potassium Tartrate.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 670–677.

The author's experiments have been carried out with rabbits, guinea-pigs, and rats, both healthy and infected with the Uganda strain of nagana. For rabbits and guinea-pigs the intravenous administration of the drug has been employed, while rats were treated by intraperitoneal injection, either distilled water or physiological salt solution being used for dissolving the drug.

The trypanocidal effects of the sera of infected animals were tested by mixing them with varying proportions of citrated blood from infected mice, while their protective properties were tested by injecting these mixtures into healthy mice subcutaneously. It was found that the serum albumins of a healthy animal did not alter the power possessed by solutions of emetic ranging from 4 per 1,000 to 1 in 20,000 of rendering trypanosomes motionless and also that stronger solutions than 1 per 1,000 produced slight haemolysis both *in vitro* and *in vivo.*

The blood of animals treated with emetic was found to coagulate more slowly than normal blood.

Guinea-pigs were treated with doses of emetic ranging from 1 to 9 mgm. per 100 grams body-weight on the fourth day after the appearance of trypanosomes in their blood. The latter dose is toxic, and generally causes death within an hour. Five minutes after the injection, blood

withdrawn from the animals failed to set up infection in healthy mice. On the other hand, there was found to be no difference in the effects of serum obtained from infected animals after treatment, and serum from infected guinea-pigs which had not been treated, normal guinea-pigs which had been treated and those which had not, when tested *in vitro*. Not only was there no trypanocidal effect, but the trypanosomes actually retained their power of movement better than in mixtures of infected mouse blood and salt solution or citrate solution.

In another series of experiments the dose of emetic was increased to 12 mgm. per 100 grammes, the animals being bled 5 minutes later. The red and white corpuscles were separated from each other and from the serum and extracted in isotonic salt solution for 24 hours.

Even in these cases neither the serum nor the extracts had any immobilising effect upon the trypanosomes *in vitro*.

It was found that when the emetic was added to the blood, after withdrawal of the latter, the serum and the extracts of the corpuscles caused a very pronounced effect upon trypanosomes, all movement ceasing in less than 5 minutes.

The author also carried out a number of experiments with salvarsan and atoxyl, and the results obtained confirmed those of LEVADITI and MUTERMILCH.

(16) BRUCE (D.). **Classification of the African Trypanosomes Pathogenic to Man and Domestic Animals.**—*Trans. Soc. Trop. Med. & Hyg.* 1914. Nov. Vol. 8. No. 1. pp. 1–22.

The author refers to the risks attaching to attempts to classify trypanosomes from the examination of strains which have been maintained for varying lengths of time in laboratories. As an example of this he instances *T. brucei*, which he says has become monomorphic, and quotes ROUBAUD to the effect that it has lost the power of developing or even surviving in the tsetse fly.

With two exceptions—viz., *T. evansi* and *T. equiperdum*—the author has worked in the field with all the trypanosomes referred to in the paper.

The classification is based upon a consideration of three characters of the trypanosomes, their morphology, their action upon animals, and their mode of development in the fly. Simplicity of classification is the author's aim, and he rejects cross-inoculation and serum diagnosis as means of identification as tending to multiply species.

The author refers to the desirability of the adoption of some standard method of studying and describing trypanosomes.

The biometric method of measurement has not yielded the results hoped for, but it is nevertheless considered as a useful means of expressing the "distribution of length" in a given species. It is advised that 1,000 trypanosomes in batches of 100 on consecutive days should be measured to supply data for the construction of a curve, a number of susceptible animals being used for the purpose, or that 1,000 trypanosomes taken at random from various susceptible animals should be drawn and measured, and that, where practicable, 100 trypanosomes from a single white rat on 10 consecutive days should be measured.

Breadth should be measured across the thickest part, including the undulating membrane.

Coloured drawings should always be included and the morphological details accurately described.

With regard to the susceptibility of animals, one must proceed with caution, as there are known instances of profound change in virulence of trypanosomes for given species under certain circumstances. For example, *T. brucei* may be rendered capable of killing white rats in two days after a long series of passages through that species. On the other hand, *T. simiae*, which when obtained from the fly kills monkeys in 10 days, becomes avirulent for the monkey after a single passage through the goat.

Cross-inoculations are difficult to carry out in the field, as immunised animals are not always available and errors may result from variation of virulence in laboratory strains.

Serum diagnosis presents great difficulty in the field owing to the impossibility of keeping a number of small animals.

In the author's classification three main groups are formed :—

A.—The *T. brucei* group. This comprises the polymorphic parasites, which make it possible to separate the parasites contained in it from the other groups by morphology alone. Two of the parasites included in this group develop in the gut of the fly and then pass to the salivary glands, where they complete their development.

B.—*T. pecorum* group. The parasites included in this group are all small and monomorphic. The development takes place in the intestine and proboscis, but the salivary glands are not invaded.

C.—*T. vivax* group. The trypanosomes of this group are monomorphic and very active. Development takes place in the labial cavity and hypopharynx, but not in the intestine or salivary glands.

Group A. comprises :—

(1) *T. brucei* Plimmer and Bradford.
Synonyms : *T. rhodesiense* Stephens and Fantham.
T. ugandae Stephens and Blacklock.

(2) *T. gambiense* Dutton.
Synonym : *T. nigeriense* Macfie.

(3) *T. evansi* Steel.
Synonym : *T. soudanense* Laveran.

(4) *T. equiperdum* Doflein.

Group B. :—

(1) *T. pecorum.*
Synonym : *T. confusum* Kinghorn and Montgomery.
T. nanum Laveran.

(2) *T. simiae.*
Synonym : *T. ignotum* Kinghorn and Yorke.

Group C. :—

(1) *T. vivax* Ziemann.
Synonym : *T. cazalboui* Laveran.

(2) *T. caprae* Kleine.

(3) *T. uniforme.*

(17) SEIDELIN (H.). **Notes on the Antagonistic Relations between Trypanosomes and Blood Elements.**—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3. pp. 315–316. With 1 plate comprising 8 figures.

The author describes briefly a process of ingestion of red corpuscles by trypanosomes which he has observed in stained and fresh preparations. The figures are taken from photographs of the various stages of the process as observed in a single preparation of the blood of a rat infected with a trypanosome of the *lewisi* type. The phenomenon is said to be uncommon, but, should it prove to be more common than it at present appears to be, it would be of importance as an anaemia-producing factor.

LEISHMANIASIS.

(18) LAVERAN (A.). **Les Leishmanioses chez les Animaux.** [Leishmaniasis in Animals.]—*Ann. Inst. Past.* 1914. Sept.–Oct. Vol. 28. No. 9–10. pp. 823–838.

ii. *Ibid.* Nov.–Dec. No. 11–12. pp. 885–912.

i. This paper is a summary of the present state of knowledge regarding Leishmaniasis in the dog. In subsequent papers the following conditions are to be dealt with: Experimental infections produced by *L. infantum*, and *L. donovani*, and natural and experimental infections with *L. tropica*.

Natural infection in the Dog.—

A historical survey is given from the discovery of the condition by NICOLLE and COMTE in 1908, the distribution of the disease being simultaneously dealt with.

The clinical aspect of the disease is referred to, and the views held by different authors regarding the identity or otherwise of the canine disease with human leishmaniasis are summarised. The author concludes that "the probabilities appear to be in favour of the identity of *L. infantum* and the Leishmania that is responsible for natural infections in the dog." It is admitted that there are certain difficulties in the way of accepting this view. The principal objections are:—the inconstant association of the canine disease and the disease in children; the rare discovery of the canine disease in houses where there are human patients; and the failure to find cases of the disease in dogs in India, if the Indian and the Mediterranean disease are identical, as seems probable.

The views of a number of authors regarding the methods of transmission of the parasite are briefly referred to, and the conclusion arrived at by the author is that the real manner of transmission has not yet been definitely discovered.

Diagnosis can only be based upon the discovery of the parasite, and where these are scanty, cultivation should be resorted to. The tubes of medium (simplified Novy) must be incubated at 22° C. for at least a month before being considered as negative.

During life puncture of the liver may be resorted to. To achieve this the puncture must be made in the 10th intercostal space, one or two fingers' breadth from the summit of the dorsal spines. This

method only succeeds when parasites are numerous. The femur may be trephined on its outer face for the taking of material for examination. It is probable that recovery frequently occurs in the dog, but no method of treatment is known.

ii. The effects of inoculation with *L. infantum* in different species.—

The parasite is transmissible by inoculation to the dog, monkey, mouse, rat, and with less ease to the guinea-pig and rabbit. It is preferable to inoculate into either the peritoneum or the liver; a considerable dose should be given. Subcutaneous inoculation generally fails. Inoculations with cultures containing the flagellate stage of the parasite are less successful than inoculations with the parasite as it occurs in the body. The parasites lose virulence under cultivation. Although young dogs are generally more easily infected than old ones, this is not always the case. The parasite can be carried on in series in dogs. The symptoms in dogs may be very slight, and a diagnosis can only be made by the discovery of the parasite. Spontaneous recovery may occur and immunity may be thereby acquired, but if a dog be re-inoculated before recovery is complete, a more severe infection often results.

The author gives a summary of 25 successful inoculations, some of which were made in Tunis by NICOLLE and some by himself in Paris.

In infected dogs the spleen is enlarged, the bone marrow is often red and diffluent, but the liver presents a normal appearance. The parasites are generally more numerous in the bone marrow than in the spleen.

The facts with regard to the experimental infection of monkeys closely resemble those already referred to in the dog. Contrary to what might be supposed, passage through monkeys produces no exaltation of virulence but a rapid attenuation. In monkeys the symptoms are more pronounced than in dogs.

In mice inoculated intraperitoneally the infection sometimes remains restricted to the peritoneum, but in other cases it becomes generalised. As with the other species referred to, inoculation with cultures of the flagellate generally fails, the parasites being promptly destroyed by phagocytes.

Inoculation of guinea-pigs fails more generally than it succeeds, and the same holds good for the rabbit.

A single natural case of the infection in the cat has been published, but experimental infection has up to the present failed completely.

Birds, lizards, and frogs have also resisted experimental inoculation.

(19) ARCHIBALD (R. G.). **A Preliminary Report on Some Further Investigations on Kala Azar in the Sudan.**—*Jl. R. Army Med. Corps.* 1914. Nov. Vol. 23. No. 5. pp. 479-495.

Inoculation experiments have shown that the following animals are susceptible to infection with kala azar:—The grey monkey, *Lasiopyga callitrichus* (*Cercopithecus sebaeus*), the jerboa (*J. gordoni*), the gerbil (*G. pygargus*), and young dogs.

In the gerbil and jerboa the infection runs a chronic course and does not appear to disturb the health of the host.

Negative results were obtained with the guinea-pig, rabbit, cat, a cheetah, and pigeons.

Cultural experiments.—

The parasite grew readily on N.N.N. medium, and cultures were also obtained on ox blood serum and Buchanan's medium containing 1 per cent. neutral red.

Sheep blood in the place of rabbit blood in the N.N.N. medium was found to inhibit growth of *Leishmania donovani*, but not of *L. tropica*. Aerobic cultures were slightly more luxuriant than cultures put up under anaerobic conditions.

From the results obtained in a number of experiments in which cultures of varying age were subjected to special conditions such as exposure to sunlight, varied temperatures, dilute solution of hydrochloric acid, tap, distilled, and river water, it was inferred that the cultural forms of the parasite possess greater vitality than they are generally credited with. Under unfavourable conditions the tendency is to revert to the cystic stage.

A few experiments designed to show whether specific agglutinins were present in the blood of infected persons or not indicated that there were none. A remarkable result was obtained when a six day old culture was mixed in equal volumes with normal serum from a healthy person. The parasites immediately became motionless with their flagella extended.

A single experiment in which a healthy monkey had administered to it faeces from an infected man yielded a negative result.

The spleen of a heavily infected monkey was emulsified and fed to a healthy monkey by means of a pipette, special care being taken to avoid contact of the pipette with any part of the mouth, thus eliminating the possibility of inoculation. The fed monkey was killed on the 36th day owing to great emaciation and weakness. The peripheral blood showed some normoblasts and cells showing punctate basophilia, but no parasites were discovered in any of the organs. An emulsion of the liver and spleen was inoculated intraperitoneally into a healthy monkey. When killed 123 days later this animal was found to be infected.

In a second feeding experiment, a monkey was infected by the administration of spleen emulsion from a fatal case of kala azar.

A healthy pup was fed on two occasions with material from the liver and spleen of infected monkeys. After two months the animal appeared to be emaciated and anaemic. No Leishmania could be found, but the liver showed oval and rounded cells containing "coccal bodies" identical with those described by SMALLMAN and the author.

The author believes these bodies to be of protozoal origin, and connected in some way with Leishmania.

An attempt to infect a puppy by feeding with cultures yielded a negative result, as did also an attempt to infect a monkey by introducing culture into the vagina.

An attempt to infect a monkey with culture by scarification also failed.

The disease as met with in the Sudan.—

Two forms of the disease are clinically recognisable: an acute form which is fatal within a few weeks or months, and a more chronic form where the patient may live for a year or more.

It is not possible to say from the data available whether there is any difference between the infection of adults and children. In one case in which spleen puncture failed owing apparently to fibrosis, liver puncture yielded material containing cells within which were included "coccal bodies." This patient recovered. The parasites were not seen in this case and cultures were negative, but it is pointed out that this is the third case in which the "coccal bodies" have been found in patients showing all the symptoms of kala azar who have recovered.

A patient showing marked enlargement of the liver and spleen associated with diarrhoea was given several injections of a vaccine prepared from a six day culture, and a sensitised vaccine was also administered. Improvement associated with decrease in size of the liver and spleen resulted, and although the spleen has not returned to the normal size there is a complete absence of fever, and at the time of writing the patient is in fairly good health.

A number of facts which appear to negative the theory that the disease is transmitted by biting insects are set down, and these may be summarised as follows :—

The disease is very uncommon among females who, in view of their mode of living, are especially liable to the bites of insects and bugs. As a rule only a single individual is attacked in a hut, while animals of various kinds which also have free access to the huts have not been found to be infected.

The high percentage of cases in which the parasite is present in the peripheral blood when compared with the distribution of the disease contra-indicates insect transmission.

The disease has not been found in an epidemic form in the Sudan.

There is no evidence of development of the parasite in lice, fleas, or bugs, and experiments with these have yielded negative results only.

Experiments *in vitro* with human serum on cultures, furnish presumptive evidence against the survival of the parasite after entering the human subject by way of the skin.

Attempts to infect *L. callitrichus* by scarification have failed.

In the author's opinion evidence is accumulating which suggests that infection may be by way of the alimentary tract. It is possibly taken in with water or with some intermediate host in the water. Recently some investigations have been made with a species of cyclops taken near Khartoum and flagellates have been found in their intestinal tract. The possibility must therefore be considered whether such crustaceans may be intermediate hosts of such parasites, as they are for such protozoa as entamoeba and trichomonas.

A large number of animals, including dogs, sheep, goats, chickens, cats, squirrels, lizards, pigeons, bats, guinea-fowls, crocodiles, hyaenas, and various species of gazelles have been examined with negative results.

(20) Patton (W. S.). **The Examination of the Peripheral Blood of 84 Patients, suffering from Kala-Azar at the General Hospital, Madras, dur ng the Period from 15th June 1912 to 15th July 1913.**—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 492–504.

The bulk of this paper consists of a tabulated statement giving brief details of each of the 84 cases.

The method of diagnosis adopted was as follows: Films were made of peripheral blood so that as many as possible of the leucocytes were collected at the ends and sides of the smears. These were stained deeply with Romanowsky and searched, preferably with a dry lens, for parasites. It is said that the parasites were usually discoverable within a few minutes. Two films were made each morning. Examination of the records yields the following information.

The parasite was found in the					1st	film in	42	cases.
,,	,,	,,	,,	,,	2nd	,,	13	,,
,,	,,	,,	,,	,,	3rd	,,	12	,,
,,	,,	,,	,,	,,	4th	,,	5	,,
,,	,,	,,	,,	,,	5th	,,	2	,,
,,	,,	,,	,,	,,	6th	,,	4	,,
,,	,,	,,	,,	,,	7th	,,	1	,,
,,	,,	,,	,,	,,	8th	,,	1	,,
,,	,,	,,	,,	,,	9th	,,	2	,,
,,	,,	,,	,,	,,	17th	,,	1	,,
,,	,,	,,	,,	,,	20th	,,	1	,,
					Total	..	84	

(21) Nicolle (C.) & Chatton (E.). **Longue Conservation de la Virulence pour l'Homme de la *Leishmania tropica*, en Cultures.** [The Long Retention of Virulence for Man of *L. tropica* in Culture.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 700–702.

One of the authors has infected himself with a strain of the parasite isolated in 1909 and since passed through 115 generations on simplified Novy medium. The inoculation was made by means of a syringe into the thickness of the skin of the forearm and the culture used was thirteen days old.

(22) Laveran (A.). **Infections Expérimentales de Souris, d'un Merione, d'un Rat et d'un Macaque par la *Leishmania tropica*.** [Experimental Infections of the Mouse, Merion, Rat, and Macacus with *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 663–670. With 2 figs.

The author's experiments have been carried out to check those published by Gonder regarding the inoculability of the mouse with *L. tropica*. He has used a strain of the same origin as that used by Gonder, viz., one obtained from the Pasteur Institute at Tunis and, as recommended by Row, has used cultures about a month old and not recent ones.

The lesions developing in infected males are thus described:—About the fourth month the testicles become swollen and indurated, and liquid obtained by puncture contains numerous parasites. Little superficial lesions make their appearance on the skin of the scrotum or tail, and the latter may be completely destroyed. Enlargement of the spleen was seen in every case but parasites were not discovered in it, nor were they found in either the liver or the bone marrow.

A female mouse which was successfully infected showed a lesion on the abdominal wall closely resembling oriental boil, and there was also a generalised infection. Parasites were present in large numbers in this lesion, as also in the liver. They were present in moderate numbers in the spleen, but scanty in the bone marrow.

In addition to mice, of which six out of twelve were successfully inoculated, the author has infected one out of three merions* caught in Tunis. In this case lesions exactly like those found in the male mice commenced to develop about the fifth month. As in the case of the mice, there were no parasites discoverable in the liver, spleen, or bone marrow.

A rat inoculated into the testicle with material derived from one of the infected mice developed a local lesion only. A similar result followed the inoculation of a rat direct into the testicle with culture of the same parasite.

A macacus monkey, inoculated with material derived from an infected mouse, showed little nodular skin lesions after an interval of about nine days. This virus was more active than that of Delhi sore with which some of the author's earlier experiments were made, but the lesions produced very much resembled each other.

While the author does not feel justified in drawing any conclusion from the results of these experiments he states that they appear to contra-indicate the identity of *L. infantum* and *L. tropica.*

SPIROCHAETOSIS.

(23) FANTHAM (H. B.). **The Granule Phase of Spirochaetes.**—*Jl. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 471–484.

In this paper an attempt is made to throw light on the much-discussed subject of the granule phase of spirochaetes and in it are incorporated results of the author's recent work.

The conclusions arrived at may be summarised as follows:—

(1) The formation of granules from spirochaetes is generally admitted, their significance only being in dispute.

(2) Danger attaches to generalisation, as it has never been asserted that all the granules seen in the tissues of infected ticks were of spirochaetal origin.

(3) The author has seen granular structures in various tissues of the ticks similar to those figured by MARCHOUX and COUVY, but often they were not so marked as represented in the figures of those authors.

(4) The full details of climatic conditions, especially humidity and temperature under which the experimental ticks were kept, must be recorded.

(5) The view is expressed that MARCHOUX and COUVY's postulate of ultra microscopic spirochaetes is weak.

(6) Small spirochaetes have been seen to emerge from granules contained in tissues from ticks by the use of dark ground illumination.

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* *Meriones:* a genus of *Muridae.*

(7) There is evidence to show that granules grow into spirochaetes *in vitro.*

(8) The author has observed the formation of granules (coccoid bodies or spores) from *Spirochaeta bronchialis.* The spirochaetiform phase of this parasite dies rapidly outside the body.

(9) SERGENT and FOLEY have shown that the spirochaete of relapsing fever in North Africa possesses a small but virulent form which is assumed during apyrexial periods in man, and during a period following an infecting meal in the louse.

PROTOZOA.

(24) **MACFIE (J. W. Scott). Notes on some Blood Parasites collected in Nigeria.**—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 439–468. With 2 coloured plates and 1 text fig.

This paper is divided into six sections dealing with the following :—

(1) The occurrence of babesiasis in domesticated animals in Nigeria ; (2) A spirochaete found in the blood of a guinea-pig ; (3) Bacilliform bodies found in the red corpuscles of a rat ; (4) A disease of fowls characterised by inclusions in the leucocytes ; (5) Blood parasites of lizards and toads ; (6) The occurrence of a spirochaete in the gut of *G. tachinoides.*

(1) Fifteen goats, seventeen Hausa cattle, two dwarf cattle, and twenty-five sheep were examined for intra-corpuscular blood parasites, and they were detected in two Hausa cattle, two dwarf cattle, and eleven sheep.

No evidence was available that the animals had shown any symptoms of illness. The blood was taken from animals about to be slaughtered.

In most cases the parasites were numerous. The description of the morphology of the parasite and the coloured illustration of it, indicate its close resemblance to *Theileria parva,* as stated by the author. But a form is figured and described which exactly agrees with the " maltese-cross " form of *Nuttallia equi.*

" Blue bodies " were not found, but apparently only blood smears were examined.

An attempt was made to cultivate the parasite, 1–10 cc. of 50 per cent. glucose solution being added to 8 cc. of defibrinated blood, the tubes being incubated at 37° C. For the experiment the blood of an infected ram was used. Parasites were fairly numerous in the blood and " dividing forms " did not exceed 4 per cent.

After six hours incubation " dividing forms " numbered 19 per cent., and at 24 hours there were 21 per cent. of these forms.

Parasites appeared to maintain their full vitality up to 90 hours, after which they seemed to decrease in numbers.

One of the Hausa cattle was also found to be infected with a Babesia. These were much larger parasites. Only two imperfect films were available for examination.

Extra-corpuscular forms containing a large mass of chromatin and a solid looking cytoplasm were found, but intra-corpuscular forms showed irregular shaped bodies with, in some cases, as many as six or seven pieces of chromatin. It is suggested that this may possibly be a new species.

In one of the dwarf cattle a parasite apparently identical with *B. bigeminum* was found.

Babesiasis in guinea-pigs.—Two babesia-like parasites have been found in these animals. They have been known to be present in the blood of an animal for months without producing any symptoms.

Paraplasma flavigenum.—This is said to resemble closely some of the forms of *Theileria parva*. It is indistinguishable from *Paraplasma flavigenum* in human blood taken from people infected with yellow fever and in the blood of guinea-pigs inoculated from such cases. In view of the endemicity of yellow fever in Nigeria the possibility is suggested that the presence of the parasite in the guinea-pig represents a natural infection.

The second parasite found in guinea-pigs resembles *Paraplasma flavigenum* but is coarser in structure and invariably causes a "stippling" of the invaded cell.

The coarseness of this "stippling" appeared to be dependent upon the intensity of the strain.

A heavily infected guinea-pig remained apparently healthy for five months, the parasites varying in number from day to day.

The name *Paraplasma cobayae* is suggested for this parasite.

(2) Spirochaete in the blood of a guinea-pig.—This organism was fortuitously isolated from the blood of a guinea-pig with which experiments were being made for the cultivation of *Paraplasma flavigenum*.

Bass's method was used and spirochaetes appeared after 46 hours incubation at 37° C. They increased up to the 79th hour when they were innumerable. All spirochaetes had vanished by the 8th day.

The parasites ranged from 2 to 9 microns in length, with exceptional ones measuring 14 microns; they showed from two to six undulations, and had blunted ends.

The parasites were still capable of multiplying on transplantation at the 100th hour, although they had undergone marked structural changes.

(3) Bacilliform bodies found in the red corpuscles of a rat.—At the time of writing the author had not had the opportunity of consulting recent literature, but since doing so he is convinced that the bodies which he saw in the blood of a rat were Grahamella.

(4) Disease of fowls characterised by inclusions in leucocytes.—This condition appears to be well known among the natives.

Symptoms.—The earliest symptom is that the infected bird stands still with its head and tail drooping, then the wings begin to droop and the bird becomes unsteady, standing with its legs wide apart. Finally it falls and remains motionless until death occurs. Diarrhoea is a marked symptom. There is not constantly any anaemia. Death generally occurs in two days.

Examination of the blood revealed the presence of chromatin granules in the cytoplasm of leucocytes. These granules varied in size and shape, the majority were large and rounded or annular, but club-shaped and signet forms occurred. Similar bodies were found in great numbers in the cells in smears from the liver and spleen, but they were often much larger and crowded together to form solid masses.

In the earlier stages of the condition red corpuscles were found, the nuclei of which stained of a rather brown tint with Giemsa. In the later stages the cytoplasm of such corpuscles was more or less stippled with brownish or purplish granules.

Twenty-eight toads (*Bufo regularis*) were examined. Trypanosomes were found in 4, microfilariae in 3, and haemogregarines in 8. Of 38 lizards (*Agama colonorum*) examined, one showed trypanosomes, 13 microfilariae, 2 haemogregarines, and 3 haemocystidia.

(6) A spirochaete in the gut of *G. tachinoides*.

Spirochaetes were found in immense numbers in the posterior part of the gut of a fly, which was dissected in the course of some experiments. This fly had fed on a normal guinea-pig for some days, but the animal showed no evidence of infection. The parasites varied in length from 7 to 35 microns, they were extremely slender, and their ends were blunt.

(25) Bouilliez (M.). **Exposé des Travaux en Cours au Laboratoire de Fort-Archambault.** [An Outline of the Work in Hand at the Fort Archambault Laboratory.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 685–694.

This report was not intended for publication, but it was thought advisable that it should be published.

Human and animal trypanosomes, with the methods of transmission, malaria, bilharziosis, and goitre are dealt with.

Human trypanosomiasis has been discovered along the course of the Bahr Sara, and it appears to have been long established there. No cases have been found along the Shari and in the valleys of Bahr Kô, except in a few villages near Fort Archambault among people who admit having lived in the infected districts of Crampel, Sibut and Bangui.

Animal trypanosomiases.—The author has had the opportunity of investigating these more particularly in equidae, as the cattle, sheep,

and goats, of which there are large numbers in Chad, do not come quite so far south as Fort Archambault. In horses the only trypanosome found appears to be *T. pecaudi.*

A number of sheep, goats, and cattle have been examined on their way through but no trypanosomes have been detected. The author was not in a position to carry out inoculation tests for the detection of infection in these animals. *T. lewisi* is very common among rats.

Two donkeys out of 22 which were passing through, were found to be infected with a trypanosome which appeared to be *T. cazalboui.*

At the time of writing, it had not been possible to investigate the question of the species of biting flies present in the area, but *G. morsitans* and *G. tachinoides* had been discovered.

Malaria.—A small number of examinations have been made to ascertain the frequence of malaria, and the figures show a percentage of 79. The majority of the parasites were of the *P. praecox* type, but *P. vivax* and another unidentified organism have been seen.

Bilharziosis of the bladder and intestine both occur, but some transmission experiments carried out with monkeys were not complete at the time of writing.

Goitre is very common among the natives.

HELMINTHS.

(26) Nicoll (W.). **On the Migration of the Larvae of *Onchocerca gibsoni* through the Capsule of the Worm Nodule.**—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 609–621.

The first three pages of this communication are occupied by a summary of the literature regarding this parasite.

The author's observations may be summarised as follows:—

Attempts were made to ascertain whether larvae were able to escape from the worm nodules and pass through the uninjured skin of the host and thus gain the exterior, as stated by Breinl.

In a number of experiments, pads soaked in sterile water were applied over nodules for periods ranging from 1½ to 3 hours at different times during the day, the water being subsequently examined for embryos. The results in every case were negative, as were also those in which the pads were replaced by small vessels containing water.

In further experiments carried out with nodules excised from carcases some positive results were obtained.

Two freshly excised nodules were obtained, one of which was surrounded by muscle and the other by connective tissue. The muscle was cut away from the nodule and divided into two portions. These two portions and the two nodules were placed in separate capsules containing filtered rain water. Two of these capsules were incubated

at 37° C. and the other two were left at room temperature (21° to 26° C.). The water was replaced at frequent intervals, each change being examined after centrifuging.

The larger (incubated) nodule and the piece of muscle which had been cut from it and left at room temperature gave negative results throughout.

The incubated piece of muscle yielded one larva after 2½ hours, and the nodule which had been left at room temperature yielded two larvae at the end of 6 hours and another, 3 hours later.

In a second experiment eight nodules were used, and the following table indicated the manner in which they were treated together with the results obtained.

Experiment started at 1 *p.m., 30th July.*

	30th July.			31st July.	1st August.
	2.15 p.m.	5.15 p.m.	9 p.m.	9 a.m.	12 noon.
5. Acidulated water, 37° C.	4	0	2	0	0
6. Acidulated water, Room temperature..	0	3	0	0	0
7. Ammoniated water, 37° C.	2	2	0	6	1
8. Ammoniated water, Room temperature..	2	12	0	0	0
9. 37° C...	42	8	0	0	3
10. Room temperature ..	439	2,000	Very numerous.	30	7
11. 37° C.	47	18	0	0	0
12. Room temperature ..	42	230	20	14	0

When the nodules were examined after the experiment, it was found that in Nos. 5 and 6 the worm appeared as a caseous mass. In Nos. 7 and 8 the worm was in good condition, but the larvae were all dead. A similar condition was found in 10 and 12, but in 9 and 11 the interior of the nodule was in a state of putrefaction.

Nodule 12 had had made in it two cross-shaped incisions $\frac{1}{16}$th inch deep before the experiment, but the others were not so treated. The absence of any cuts or perforations was confirmed by examination of the nodules after the experiment.

Three further series of experiments were made on much the same lines and the details are given in tabular form showing the methods of treatment and the results obtained.

These may be summarised as follows :—

The experiments go to show that Onchocerca larvae can escape from the nodules, usually in small numbers, but at times in comparatively large numbers.

The fact that the embryos were found to be incapable of maintaining their existence in water for more than two days must be placed against the view that the infection is water-borne, although it cannot be excluded. Water-born infection, either direct or through an intermediate host, must be considered as a possibility.

Further bias in favour of water-borne infection is the analogy between Onchocerca and guinea-worm. On the other hand, the adult worm is so closely allied to the Filariae that insect transmission seems to present the greatest measure of probability.

If it be the case that larvae emerge through the skin of their own accord some non-biting insect might become infected, but in that case it would be difficult to explain re-inoculation.

(27) Mitra (S. B.) & Ganguly (H. C.). **Canine Filariasis.**—*Vet. Jl.* 1915. Jan. Vol. 71. No. 475. pp. 40–42. With 1 text fig.

The filariae which are briefly described in this note were found in the blood of a kangaroo hound dog. Their presence was associated with a variable temperature, and they appeared to be less numerous in the morning than in the evening.

The average length of the parasites was 300 microns and they were therefore longer than *Acanthocheilonema recondita* and *A. dracunculoides*, which are said not to exceed 230 microns.

Their size places them between *Dirofilaria repens* and *D. immitis*, and the authors are inclined to identify them with the latter.

(28) Sergent (Edm.). **Première Note sur les Phlébotomes Algériens.** [First Note on the Algerian Phlebotomes.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 660–662.

The author gives the following list of species of Phlebotomus and their geographical distribution :—

Coast—

Phlebotomus papatasii Scopoli. Very common in July, August, and September.

Upper Plateaus (from 800 to 1,000 metres)—

Phlebotomus papatasii Scopoli.
„ *minutus* var. *africanus* Newstead.
„ *perniciosus* Newstead.

All these occur during the first three weeks of September only.

Sahara—

Phlebotomus papatasii (from the middle of May till October at Beni-Ounif-de-Figuig).

At Biskra *P. papatasii* and *P. minutus africanus* appear in about equal numbers, but *P. perniciosus* is more rarely seen.

(29) Lane (C.). **Suckered Round-worms from India and Ceylon.**— *Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp, 655–669. With 8 plates.

The following is a list of the parasites described in this paper :—

Heterakinae—

Heterakis bosia, n. sp., Tragopan pheasant.
„ *putaustralis*, n. sp., Domestic fowl.
Ganguleterakis gangula, n. gen., n. sp., *Mus decumanus*.
Ascaridia hamia, n. sp., Domestic fowl.
Kathlania kathlena, n. gen., n. sp., *Chelone midas*.
„ *tonandia*, n. sp. *Chelone midas*.

MISCELLANEOUS.

(30) Seidelin (H.). **Klossiella sp. in the Kidney of a Guinea-pig.**— *Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 553–564. With 2 plates comprising 27 figures.

The parasite described in this paper has been found in the kidneys of a guinea-pig at the Medical Research Institute, Yaba, Nigeria.

To the naked eye the kidneys presented a normal appearance, and apart from the presence of the parasite in the renal epithelium the microscopic alterations were similar to those seen in many animals infected with yellow fever as was the case with this guinea-pig.

The coccidium-like parasite was found in larger or smaller numbers in every section examined.

The earliest stage of the parasite appears to be a small rounded body measuring about 2 microns in diameter with an irregular shaped nucleus and scanty cytoplasm.

The parasite increases in size until it measures about 6 microns when the nucleus begins to divide up into daughter nuclei which eventually dispose themselves at the surface of the cytoplasm. The daughter cells are formed apparently by a process of budding, and the number varies from 16 to 20. These again become divided and produce about 30 small fusiform structures, measuring about 8 microns by 1·5.

The parasites occur in the epithelium of the convoluted tubes and of the loop of Henle.

Parasites were not found in the straight tubes nor in the pelvis.

No opportunity occurred to follow up the life cycle of the parasite, as it was found in sections which were being examined in the course of other observations.

Should the parasite prove to be a new species, the name *Klossiella cobayae* is suggested.

(31) WENYON (C. M.) & LOW (G. C.). **The Occurrence of Certain Structures in the Erythrocytes of Guinea-pigs and their Relationship to the So-called Parasite of Yellow Fever.**—*Jl. Trop. Med. & Hyg.* 1914. Dec. 15. Vol. 17. No. 24. pp. 369–372. With 1 coloured plate.

This paper deals with the discovery by the authors of certain bodies within the red corpuscles of healthy guinea-pigs which appear to be identical with those described by SEIDELIN, and MACFIE and JOHNSTON, and called by them *Paraplasma flavigenum*, which they found in the red blood corpuscles in cases of yellow fever and which were said to be inoculable to guinea-pigs in series.

AGRAMONTE and SCHILLING-Torgau have already published observations of the same nature.

The bodies in question are particularly numerous in newly-born animals, and this fact contraindicates their parasitic nature, as placental transmission is exceedingly rare in parasitology. With increasing age they disappear.

It is probable that the bodies represent some of nuclear material.

In suitably stained preparations the bodies may be seen as minute red granules, one or more being present in a single cell. In some cases the red speck is associated with bluish-grey material which suggests cytoplasm. The arrangement of this material is very variable. The explanation of its presence is difficult to furnish. In some cases the bodies have a definite ring shape with a lateral red dot much like a ring form of piroplasm save that they are much smaller.

The authors believe that the bodies are real structures and not artefacts. The remainder of the paper deals with the possible connection between these bodies and yellow fever.

(32) SMITH (A.) & MITTER (S. N.). **A Brief Note on an Outbreak of Septicaemia among the Monal Pheasants of the Calcutta Zoological Garden.**—*Vet. Jl.* 1914. Jan. Vol. 71. No. 475. pp. 37–40.

The authors believe that the disease responsible for the deaths of the pheasants was identical with that described by GAMALIA in 1888 as occurring among fowls in Southern Russia.

They isolated an organism which agreed in its morphological and cultural characters with the *Vibrio metchnikovi*.

In experimentally inoculated rabbits and fowls death took place within 24 hours provided the animals were young. Adult birds and rabbits offered a considerable degree of resistance.

In natural cases the lesions appeared to be confined to the alimentary canal, which showed evidence of very severe inflammation.

The organism is said to occur "in thick curved blunted rods, or resembling cocci or small bacteria in the short thicker specimens, or in spiral filaments."

The organism is stainable by the simple anilin dyes, but not by Gram's method.

In broth it produces turbidity and a surface scum.

On agar there is a luxuriant yellowish-white growth.

In stab gelatin there is liquefaction and gas formation. On potato a yellowish brown growth develops.

In eggs inoculated according to Huppe's method the white is converted into a turbid yellow liquid and the yolk becomes quite black.

Indol was developed in the cultures.

(33) Holmes (J. D. E.). **A Note on the Effect of Heat on the Rinderpest Immune Bodies.**—*Bull. No. 43. Agricultural Research Institute. Pusa,* 10 pp. 1914. Calcutta: Superintendent Government Printing. India.

The experiments recorded in this paper were carried out with the double object of ascertaining: (1) whether exposure to a moderately high temperature for several days, or to a high temperature for a short time had any detrimental effect on the serum; (2) the effects of sterilisation on the potency of the serum.

Certain tests carried out by Lingard appeared to show that the subjection of the serum to moderate temperatures for considerable periods (some months) produced deterioration.

Three sets of experiments were carried out. In the first the serum was exposed to a temperature of 45° C. for 7 days before use. This degree of heating was found to be without effect upon the protective power of the serum.

In the other two series of experiments the serum was heated to 55° and 65° C. respectively for one hour, and in both instances the original potency of the serum was retained.

The conclusions are drawn that anti-rinderpest serum can be sterilised with safety, and that the action of the serum is not dependent upon a complement present in itself.

(34) **M'Leod (J. W.) & Soga (A. R. B.). A Simplified Method for the Cultivation, in Fluid Media containing Coagulable Albumin, of Bacteria requiring Anaerobic Conditions, notably the Pathogenic Spirochaetes.**—*Jl. Path. & Bact.* 1914. Oct. Vol. 19. No. 2. pp. 210–213. With 1 text fig.

A tube is fitted with an india rubber bung carrying a piece of glass tubing which does not quite reach the lower surface of the bung. Above the bung the tube is drawn out and bent over at an acute angle. The tube is filled to half or two-thirds of its depth with broth, which is then sterilised in the autoclave. When the liquid is cool sterile rabbit kidney is introduced. The tube is inoculated by dropping into it a bead through which is passed a piece of cotton wool soaked in the seed material. This ensures the seed material shall be near the piece of kidney where conditions are most suitable for growth. Finally ascitic fluid is run in until the level of the liquid is within half the length of the bung from the top of the tube. The bung is then pushed in, the liquid rises up in the tube and when it reaches the end of the drawn out tube this is sealed off.

The method is not applicable to gas producing bacteria.

The authors have been able to cultivate three strains of spirochaetes received from NOGUCHI by this method, 50 to 60 per cent. of the cultures being successful.

(35) CHATTERJEE (G. C.). **A Culturable Free Living Flagellate and the Determination of the Lethal Value of Certain Chemicals thereon.**—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 594–603. With 1 coloured plate.

The flagellate, which discovered in a sample of tank water was found to grow very well in broth or peptone water.

The organism possessed two flagella, a rudimentary undulating membrane, and basal granules. The morphology varied somewhat according to the medium used for cultivation. The large forms which developed in broth measured 10 to 20 microns in length by four in width, and the flagella were of unequal length measuring 10 and 5 microns.

In salt solution shrunken elongated forms were found. In tap water large spherical forms developed. The identity of these different types was proved by cultivation experiments.

Multiplication occurred at 18° and 20° C., but it was more vigorous at body temperature. At 40° C. multiplication ceased and at 45° C. the parasite died in five minutes.

Tabular statements are given of the effects of a number of chemical substances used on the lines of the Rideal Walker tests.

REPORTS.

(36) GOLD COAST. **Report on the Veterinary Department for 1913, by** W. P. B. BEAL. 1914. 24 pp. f'cap. Accra: Printed at the Government Press.

Anthrax.—One suspected case occurred in a horse, the animal being destroyed.

Contagious Bovine Pleuro-pneumonia.—One outbreak occurred at Colebro in N.W. Ashanti and one at Nantong in the Northern Territories.

Trypanosomiasis.—Treatment of horses suffering from this disease has been carried out on the same lines as before (see this *Bulletin*, Vol. 1, p. 188), but the orpiment was given *in bolus* instead of in drenches.

The atoxyl injections were repeated on the 6th and 7th days because there is a rise of temperature observed from the 5th to the 8th days.

There is evidence to show that the cures effected are not permanent, the apparently cured animals harbouring trypanosomes in the blood.

Tabanidae.—The following species have been caught: *T. besti* Surc., *T. kingsleyi* Ric., and *T. marmoratus* Surc.

The commonest trematode worm is *Gastrodiscus aegyptiacus*, and it is estimated that 75 per cent. of the horses are hosts of this parasite. It is easily expelled by anthelmintics and aloes.

(37) **British East Africa. Annual Report 1912–1913. Dept. of Agriculture. [Veterinary Department** by R. J. Stordy. pp. 23–41.]

East Coast Fever.—The inoculation with spleen or gland pulp according to Theiler's method is considered to be inapplicable owing to the high death-rate caused, and it is stated that a method of vaccinating with infective spleen pulp, peptone, and blood from an immune animal is being elaborated at Kabete Laboratory. Investigations have been made into the "frequent dipping" method of dealing with the disease.

Rinderpest.—The mortality caused by this disease cannot be estimated, but it has occurred in all but a few districts.

It is reported the Masai have no desire to escape the disease and even introduce it, as they are willing to pay the toll in young stock in order to have immune survivors.

Attention is drawn to varying virulence of the strains and the varying degree of its rapidity of spread.

Pleuro-pneumonia.—No outbreaks of this disease have been recorded.

Quarter Evil.—Outbreaks have occurred, but a vaccine has been prepared to combat this disease.

Anaplasmosis.—This disease has been slightly more prevalent than during the preceding year.

Trypanosomiasis of Cattle.—No case has come under notice except a few among cattle imported from Uganda for experiment.

Ephemeral Fever or Three Days' Sickness.—Several outbreaks have been recorded from the neighbourhood of Nairobi. This disease is due to a specific organism which is present in the blood of sick animals, and the disease can be transmitted by the inoculation of such blood.

Animals of all ages and breeds are susceptible, but young animals appear to be more resistant than adults, and in animals in fat condition the disease runs a more rapid course than in those in poor condition.

The period of incubation after blood inoculation is two or three days, and the period of immunity resulting from infection is six weeks. The blood of a recovered animal is non-infective.

The symptoms are:—Elevation of temperature with the usual external evidences of fever, watery discharge from the eyes and nose, painful lameness in one or more limbs, which may rapidly pass from one limb to another, stiffness of the whole body and especially of the neck, the latter being associated with difficulty in swallowing, constipation with faeces covered with mucus. Within 48 hours the symptoms begin to abate and by the third day the animal is generally convalescent.

The only constant lesion is enlargement of the lymphatic glands, particularly the prepectoral group.

The disease is seldom or never fatal, but a fatal result may follow an attempt to drench an animal that cannot swallow.

Although it has been suggested that the disease is insect transmitted, there is no evidence to that effect.

The number of cattle affected ranges from 12 to 33 per cent. of the total number in the herd.

Horse Sickness has been very prevalent.

A disease closely resembling horse sickness, but which appears to be non-transmissible by blood inoculation has been observed.

Epizootic Lymphangitis is widespread in the country, and possibly a quarantine station will have to be established at Rumuruti for importations from the North. "606" was found to be useful in the early stages of the disease.

Ulcerative Lymphangitis has been reported mainly from the Uasin Gishu Plateau.

Experiments are in hand regarding this disease.

Strongylosis in Sheep is very widespread and is responsible for great losses. Drenching with lysol has had the most beneficial results.

Warty Papillomata of the face, lips, and feet of Sheep.—This is a common condition on the Uasin Gishu Plateau.

In the early stages there are dry warty tumours on the lips. These increase in size and become horny. If peeled off a tender raw surface is left. The ears and coronets may also be affected.

In pure and half-bred imported sheep the course of the disease is generally acute and the mortality higher than in indigenous hairy sheep. Goats are not affected, and the disease appears to be contagious.

Swine Fever.—Three outbreaks have occurred, with a mortality of 100 per cent.

This is just a possibility that a protective serum will be obtainable, as one pig at the laboratory appears to be acquiring a resistance through the injection of virus attenuated by heat.

Tick fever in the dog has been as prevalent as usual, and trypanblue has given good results.

A form of distemper, which appears to be somewhat different from the English type of the disease has been prevalent.

Rabies.—A number of cases occurred in dogs as a result of the bites of jackals, and though a number of natives were bitten no cases of hydrophobia have resulted. It is said that the form of rabies occurring in British East Africa resembles that described as occurring in Senegal, which chiefly affects dogs.

(38) Egypt. **Annual Report of the Veterinary Service for 1913. Ministry of Agriculture.** 1915. 27 pp. Cairo: Government Press.

Cattle Plague.—This disease has been responsible for 2,314 deaths, including 490 following double inoculation in outbreaks. The death-rate from natural infection was about 0·14 per cent. The number of cattle inoculated was 178,495. Of these, 569 died of rinderpest and 1,452 of other diseases, including 908 of Texas fever. In areas where double inoculation was systematically carried out, no subsequent cases occurred. The percentage of deaths following the inoculation was 1·12.

Rabies was observed in 74 cases among animals, which included two cats, one donkey, and one wolf, the remaining cases being in dogs.

Sixty-six cases of glanders were detected, and 20 of epizootic lymphangitis.

Five hundred and forty-four cases of anthrax were reported, of which 527 were in sheep.

Sheep-pox cases numbered 132.

Three hundred and forty cases of foot-and-mouth disease occurred.

Ten cases of trypanosomiasis were detected. One of these was in an ox, in which species the disease has not previously been detected in Egypt. The parasite appeared to be identical with *T. theileri*.

Filariasis was detected in two camels.

Piroplasmosis was reported in 946 cases, mainly due to double inoculation.

No cases of stiff sickness were reported.

Eighty-nine cases of contagious bovine pleuro-pneumonia were reported.

Three horses, which had been treated for trypanosomiasis two years previously with apparently complete success, were tested by the inoculation of their blood into dogs. In each case the dogs failed to become infected and were subsequently proved to be susceptible.

(39) Sinclair (J. M.). **Report of Enquiry into the Health of Cattle in Texas** [MS.]. Dated Dec. 31st. 1914.

Redwater.—This disease is confined to the Southern half of Texas, and is slowly being stamped out. Young animals appear to be more seriously affected than is the case in Rhodesia.

The effects following inoculation of pure bred stock are practically identical with those observed in Rhodesia except that the mortality due to inoculation is put at 3 per cent., and on subsequent exposure to infection at 5 per cent., but the latter figure is said to be sometimes much higher.

"In Rhodesia the heavy mortality has been attributed to anaplasmosis or gall sickness, which, according to Theiler and other observers, is a disease entirely different from redwater. The results of Bevan's work during the last two years have caused him to doubt the separate identity of the two diseases—viz., redwater and gall sickness—and in this he is supported by the fact that conditions exactly the same, as far as I can judge, are regarded by Francis and other American observers as part and parcel of redwater."

Nodular Vaginitis.—The nodular condition of the mucous membrane and the muco-purulent discharge may make their appearance when the animal is a few weeks old and persist for three or four years. Sinclair thinks the weight of evidence is with those who attribute abortion, retention of the placenta, and diseased conditions of the uterus to oviducts and ovaries which cause sterility. The condition is widely spread in the United States, and though no Texan stockowner was met who knew of the disease, its discovery in a large proportion of animals at the Meat Inspection Department at Fort Worth proves its existence.

Infectious Abortion is very widespread in Texas, especially in dairy herds.

Anthrax and black quarter are responsible for great losses. The Pasteur method of vaccinating with vaccine prepared by commercial firms has yielded very unsatisfactory results.

Psoroptic mange occurs to a considerable extent.

Foot-and-mouth disease was not existent in Texas at the time of writing, but it had broken out in 13 States in the United States a month or two previously.

Contagious pleuro-pneumonia does not occur.

Tuberculosis.—This is very prevalent among dairy cattle, and has been frequently demonstrated among the range cattle.

The report concludes with suggestions based upon the information obtained as to the steps that should be taken if animals are imported into Rhodesia from Texas.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 2, No. 4, pp. 203–204.]

Anaplasmosis.

(40) SANGIORGI (G.). Reperto di "Corpi Anaplasmasimili" nel Sangue dell'Uomo e degli Animali. [The Discovery of Anaplasma-like Bodies in the Blood of Man and Animals.]—*Pathologica.* 1915. Jan. Vol. 7. No. 149, pp. 27–29.

Leishmaniasis.

(41) CHRISTOPHERSON (J. B.). On a Case of Naso-oral Leishmaniasis (corresponding to the Description of Espundia); and on a Case of Oriental Sore, both originating in the Anglo-Egyptian Sudan.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 485–494. With 2 plates.

(42) MACKIE (F. P.). The Progress of Kala-Azar in a Localised Community.—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2, pp. 505–509.

(43) MACKIE (F. P.). Note on Some Bodies of Unknown Nature found in the Faeces of Kala-Azar Patients.—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2, pp. 510–515. With 1 coloured plate comprising 3 figs. and 1 map.

Tick Paralysis.

(44) TODD (J. L.). Tick Paralysis.—*Jl. of Parasitology.* 1914. Dec. Vol. 1. No. 2, pp. 55–64.

Biting Flies and Ticks.

(45) CORNWALL (J. W.) & PATTON (W. S.). Some Observations on the Salivary Secretion of the Commoner Blood-sucking Insects and Ticks.—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2, pp. 569–593. With 2 charts.

(46) NUTTALL (G. H. F.). Tick Abnormalities.—*Parasitology.* 1914. Oct. Vol. 7. No. 3, pp. 250–257. With 11 text figs.

(47) NUTTALL (G. H. F.). Penetration of Ixodes beneath the Skin.—*Parasitology.* 1914. Oct. Vol. 7. No. 3, pp. 258–259.

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Helminths.

(49) CORT (W. W.). Larval Trematodes from North American Fresh-water Snails.—*Jl. of Parasit.* 1914. Dec. Vol. 1. No. 2, pp. 65–84. With 15 text figs.

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(54) FANTHAM (H. B.) & PORTER (A.). The Morphology, Biology, and Economic Importance of *Nosema bombi*, n. sp., Parasitic in various Humble Bees (*Bombus* spp.).—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 623–638. With 1 plate.

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